



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2004-AAL-104-OE

Issued Date: 05/23/2008

Steve Gilbert
Chugach Electric Association, Inc
5601 Minnesota Drive
Anchorage, AK 99519-6300

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine
Location:	Anchorage, AK
Latitude:	61-09-32.51N NAD 83
Longitude:	150-13-36.00W
Heights:	351 feet above ground level (AGL) 600 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure would have no substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on the operation of air navigation facilities. Therefore, pursuant to the authority delegated to me, it is hereby determined that the structure would not be a hazard to air navigation provided the following condition(s) is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

- ☐ At least 10 days prior to start of construction (7460-2, Part I)
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.

Any height exceeding 351 feet above ground level (600 feet above mean sea level), will result in a substantial adverse effect and would warrant a Determination of Hazard to Air Navigation.

This determination expires on 11/23/2009 unless:

- (a) extended, revised or terminated by the issuing office.
- (b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within

6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

This determination is subject to review if an interested party files a petition that is received by the FAA on or before June 22, 2008. In the event a petition for review is filed, it must contain a full statement of the basis upon which it is made and be submitted in triplicate to the Manager, Airspace and Rules Division - Room 423, Federal Aviation Administration, 800 Independence Ave., Washington, D.C. 20591.

This determination becomes final on July 02, 2008 unless a petition is timely filed. In which case, this determination will not become final pending disposition of the petition. Interested parties will be notified of the grant of any review. For any questions regarding your petition, please contact Office of Airspace and Rules via telephone -- 202-267-8783 - or facsimile 202-267-9328.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

This aeronautical study considered and analyzed the impact on existing and proposed arrival, departure, and en route procedures for aircraft operating under both visual flight rules and instrument flight rules; the impact on all existing and planned public-use airports, military airports and aeronautical facilities; and the cumulative impact resulting from the studied structure when combined with the impact of other existing or proposed structures. The study disclosed that the described structure would have no substantial adverse effect on air navigation.

An account of the study findings, aeronautical objections received by the FAA during the study (if any), and the basis for the FAA's decision in this matter can be found on the following page(s).

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact Robert Van.haastert, at (907) 271-5863. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2004-AAL-104-OE.

Signature Control No: 379686-102143681

(DNH)

Kevin P. Haggerty

Manager, Obstruction Evaluation Service

Attachment(s)

Additional Information

NARRATIVE AERONAUTICAL STUDY NO. 2004-AAL-104-OE

Abbreviations

AGL - above ground level	MSL - mean sea level	RWY - runway
IFR - instrument flight rules	VFR - visual flight rules	nm - nautical miles
EMI - electromagnetic interference	ILS - instrument landing system	ft. -- feet

Part 77 - Title 14 Code of Federal Regulations (CFR) Part 77, Objects Affecting Navigable Airspace

1. LOCATION OF PROPOSED CONSTRUCTION

The proposed wind turbine locations are contained on Fire Island, within nine (9) nm west of the Airport Traffic Control Tower (ATCT) at Ted Stevens Anchorage International Airport (ANC). The Fire Island wind turbine original proposal included 33 wind turbines incorporating the Vestas V90-3.0MW generator in a nacelle mounted on 262 foot steel poles, roughly 20 miles of transmission power lines, and an electrical substation to transfer wind generated power to the Anchorage area electric grid. Each wind turbine generator evaluated had a rated electrical output of 3,000 kilowatts and the wind turbine blades had a 90 meter (295 feet) diameter span. A table detailing the 33 wind turbine locations is located in the Determination of Presumed Hazard (DPH) dated September 2, 2005, at end of this narrative.

2. OBSTRUCTION STANDARDS EXCEEDED

FAA Order 7400.2, Procedures for Handling Airspace Matters, Section 3. Identifying/Evaluating Aeronautical Effect, paragraph 6-3-2 Scope, states Part 77 establishes standards for determining obstructions to air navigation. A structure that exceeds one or more of these standards is presumed to be a hazard to air navigation unless the obstruction evaluation study determines otherwise. An obstruction evaluation study shall identify:

a. The effect the proposal would have:

- 1) On existing and proposed public-use and military airports and/or aeronautical facilities.
- 2) On existing and proposed VFR/IFR aeronautical departure, arrival, and en route operations, procedures, and minimum flight altitudes.
- 3) Regarding physical, electromagnetic, or line-of-sight interference on existing or proposed air navigation, communications, radar, and control system facilities.
- 4) On airport capacity, as well as the cumulative impact resulting from the structure when combined with the impact of other existing or proposed structures.

b. Where marking and/or lighting is necessary.

The wind turbine structures that exceed 600 ft. MSL, 22 of the original 33, are identified as Part 77 obstructions, Section 77.23(a)(3) - A height that increases a minimum instrument flight altitude within a terminal area of an airport. Any structure height exceeding 600 ft. MSL would adversely impact the ANC Category (CAT) III ILS instrument procedure. ANC is one of only two airports in Alaska with a CAT III ILS. Any structure exceeding 600 ft. MSL will create a significant adverse impact and an immediate Hazardous condition.

The FAA found two significant EMI impacts, which are detailed in the 2005 DPH, included at the end of this narrative. The ANC conventional Very High Frequency Omnidirectional Range (VOR) navigational facility and the ANC Airport Surveillance Radar (ASR)-8 radar were found to have significant adverse impacts. The wind turbine proposal included wind turbine blades with a 90-meter (295 feet) diameter span and an operational rotation specification, 9-19 revolutions per minute. Wind turbine blade speed at 19 rpm, at the outer tip, would be in excess of 200 miles per hour.

ANC VOR MITIGATION

The FAA Technical Center conducted further analysis simulating replacing the conventional VOR with a new-generation, Doppler VOR (DVOR) on the Fire Island wind turbine proposal. Three studies were conducted and the final study used a maximum wind turbine mast height of 250 feet ft. MSL.

The DVOR study, conducted with a maximum mast height of 250 ft. AGL, identified 12 wind turbines that would significantly impact the DVOR and needed to be removed from the project. Seven (7) other wind turbines locations were approved for construction with the provision that their mast heights shall be below the technical specifications submitted in the original proposal. Additionally, the DVOR study found that three (3) new wind turbine locations could be added to the proposal at the southern tip of Fire Island and would not cause DVOR interference.

For VOR EMI mitigation, the conventional VOR would have to be replaced by a proponent-funded DVOR and the Fire Island wind turbine project shall be modified from the original proposed 33 wind turbines to a revised number of 24. Five of the remaining 24 shall have reduced mast heights.

Additionally, replacing the ANC conventional VOR with a new DVOR will impact each ANC standard instrument approach procedure (SIAP), Departure Procedure (DP), & Standard Arrival Route (STAR) which may require extensive Terminal Instrument Procedures (TERPS) design work, an aircraft flight check for validation of facility performance, and air traffic controller training. Revising any air traffic routes below 3,000 ft. MSL will initiate National Environmental Policy Act (NEPA) requirements leading to an Environmental Assessment and/or an Environmental Impact Statement. Each VOR Federal Airway and Jet Route involved with this change will require TERPS design work, an aircraft flight check for validation, along with extensive rulemaking procedures detailed in Title 14 Code of Federal Regulation part 71.

ANC RADAR MITIGATION

Spinning wind turbine blades created significant radar processing problems that the older ASR-8 could not mitigate. The FAA is currently in the process of replacing the ASR-8 with a new Raytheon-designed, ASR-11 radar, which incorporates digital processing techniques that could be modified to mitigate the wind turbine EMI. The FAA along with the Fire Island wind turbine project consortium, (Municipal Power & Light, Chugach Electric Association, Golden Valley Electric Association, Homer Electric Association, Cook Inlet Region Incorporated, and Wind Energy Alaska) has been funding ASR-11 radar/software modifications over the past several years. ASR-11 radar modeling on the revised 24 wind turbine project has shown potential that the recent radar/software modifications could mitigate the spinning blade EMI and meet basic airport surveillance requirements. The ASR-11 is currently under operational evaluation trials and a commissioning decision is expected.

ASR-11 acceptance and commissioning shall be required for ANC radar EMI mitigation.

3. EFFECT ON AERONAUTICAL OPERATIONS

a. The impact on arrival, departure, and en route procedures for aircraft operating under VFR follows: An existing departure procedure, Fire Island Route, allows pilots departing Campbell Lake to stay low-level and fly around the Anchorage Class C controlled airspace to the west and depart to points north. Pilots on the Fire Island Route fly this procedure without the requirement to contact air traffic controllers nor have a transponder-equipped aircraft. The Anchorage Class C airspace was designed with this specific 600 foot exclusion area for operations to/from Campbell Lake. The 600-foot altitude limit for the route is an upper limit that provides pilots flying it at least 1,000 feet of vertical separation from any heavy jet aircraft that might be on final to ANC Runway 7R or 7L. Changing the minimum altitudes for this departure procedure

with the construction of the proposed wind turbines would place small aircraft in unsafe proximity to heavy jet aircraft wake turbulence. Wind turbulence was not part of the scope of this aeronautical study. Wind turbine obstruction marking and lighting would be white paint on the structures along with synchronized flashing red lights as outlined in chapters 4, 12, and 13, of Advisory Circular AC 70/7460-1K. The advisory circular is available online at https://oeaaa.faa.gov/oeaaa/external/content/AC70_7460_1K.pdf. It is also free of charge, from the Department of Transportation, Subsequent Distribution Section, M-494.3, 400 7th Street, SW, Washington, DC 20590.

- b. The impact on arrival, departure, and en route procedures for aircraft operating under IFR follows: The absolute maximum height of any structures on Fire Island is 600 ft. MSL. Any structure height exceeding 600 ft. MSL would adversely effect the ANC Category (CAT) III instrument landing system (ILS). ANC is one of only two airports in Alaska with a CAT III ILS. Additionally, maintaining two operational radars (ASR-8 and ASR-11) would create a mosaic radar situation that would adversely impact the ANC efficiency and capacity by requiring additional aircraft separation. Impacts to aircraft radar altimeter systems were not part of the scope of this aeronautical study.
- c. The impact on all-existing public-use airports and aeronautical facilities follows: There are no impacts to the Long Range surveillance radars and no other impacts were identified.
- d. The impact on all planned public-use airports and aeronautical facilities follow: None.
- e. The cumulative impact resulting from the proposed construction or alteration of a structure when combined with the impact of other existing or proposed structures follows: None.

4. CIRCULARIZATION

The Fire Island Wind Turbine project was circularized to the public under one aeronautical study number, 2004-AAL-104-OE, on 20 March 2008 and the published comment period ended on 26 April 2008. One public comment was received from the Airport Owners and Pilots Association (AOPA) objecting to the wind turbine project based on the identified impacts to the conventional VOR, the ASR-8, and that the wind turbines adversely impacts low-level VFR transition around the Anchorage Class C airspace to the west for northern departures.

The FAA concurs with AOPA that these are valid concerns but adequate mitigation actions will be taken. The existing VOR will be replaced by a Doppler VOR and the existing ASR-8 will be replaced by the ASR-11. The VFR aircraft departing/arriving the Anchorage area avoiding the Anchorage Class C will no longer have the option to fly over Fire Island on their northbound routes. They will have to fly around the southern tip of Fire Island before heading northbound. This ground track south of Fire Island is the current expected VFR arrival/departure and not having the option to fly over Fire Island is not an adverse condition.

The original 32 wind turbine aeronautical study numbers are 2004-AAL-104 thru 136-OE.

This public notice was initiated before the final ASR-11 commissioning action as an effort to identify any other aviation issues or concerns not previously identified by the FAA. This Determination of No Hazard (DNH) is an effort to update and finalize the 2005 FAA DPH which prevented public funds to be allotted and committed by Denali Commission and the State of Alaska for pre-construction studies.

5. DETERMINATION - NO HAZARD TO AIR NAVIGATION

It is determined that the modified Fire Island Wind Turbine project would not have a substantial adverse effect on the safe and efficient use of navigable airspace by aircraft provided the requirements listed in the CONDITIONS below are followed.

6. BASIS FOR DECISION

The Anchorage operational ASR-8 radar can not mitigate the significant wind turbine induced EMI creating significant adverse impacts to the ANC efficiency and capacity. This Determination is dependent on a new digital ASR-11 radar commissioned for operation and a written concurrence from the Western Area Terminal Director's office that the risk to the ANC TRACON operation is acceptable. Additionally, the proposed modified Fire Island Wind Turbine project would adversely impact the conventional VOR and pre-conditions shall be met before any wind turbine foundations are constructed.

7. CONDITIONS

A. No portion of the Fire Island Wind Turbine project, including the tips of the wind turbine blades, may exceed 600 ft. MSL. Exceeding 600 ft. MSL will create significant adverse impact to the ANC Category III Instrument Landing System and would present an immediate Hazard condition that will negate the entire FAA Determination for the Fire Island Wind Turbine project.

B. Each wind turbine site shall be surveyed to validate the site elevation. The wind turbine site surveys must contain a surveyor's statement that the horizontal accuracy is within +/- 15 feet and the vertical accuracy is within +/- 3 feet.

C. The proponent shall fund, via a reimbursable agreement with the FAA, the procurement, installation, and flight check of a new Doppler VOR (DVOR) to replace the existing, conventional VOR. Additionally, the proponent shall fund any Rulemaking Actions should any Rulemaking Actions be necessary with a new VOR facility three-letter identification.

D. The DVOR shall be commissioned and operational prior to erecting any Wind Turbine mast structure.

E. Twelve (12) of the original 32 aeronautical study proposal sites are permanently abandoned to prevent DVOR EMI. The 12 wind turbines are identified by the proponent as WT numbers 1, 2, 3, 7, 10, 23, 24, 28, 30, 31, 32, & 33. The aeronautical study numbers are:

2004-AAL-104-OE, WT-1;
2004-AAL-105-OE, WT-2;
2004-AAL-106-OE, WT-3;
2004-AAL-110-OE, WT-7;
2004-AAL-113-OE, WT-10;
2004-AAL-126-OE, WT-23;
2004-AAL-127-OE, WT-24;
2004-AAL-131-OE, WT-28;
2004-AAL-133-OE, WT-30;
2004-AAL-134-OE, WT-31;
2004-AAL-135-OE, WT-32; and
2004-AAL-136-OE, WT-33.

F. The maximum wind turbine mast height is 250 ft. AGL. Two wind turbines (WT numbers 12, & 13) shall reduce their mast heights and five (5) other wind turbines (WT numbers 22, 25, 26, 27, & 29) shall significantly reduce their mast heights below the approved 250 AGL height. These are the identified wind turbines with reduced mast heights:

2004-AAL-115-OE, WT 12, maximum WT mast height 249 ft. AGL;
2004-AAL-116-OE, WT 13, maximum WT mast height 243 ft. AGL;
2004-AAL-125-OE, WT-22, maximum WT mast height 205 ft. AGL;
2004-AAL-128-OE, WT-25, maximum WT mast height 179 ft. AGL;
2004-AAL-129-OE, WT-26, maximum WT mast height 177 ft. AGL;
2004-AAL-130-OE, WT-27, maximum WT mast height 162 ft. AGL; and
2004-AAL-132-OE, WT-29, maximum WT mast height 167 ft. AGL.

G. Three (3) new wind turbine locations (S1-S2-S3) identified to be located at the southern tip of Fire Island are in the group which would not cause DVOR EMI. These three new locations may be filed on-line at <http://oeaaa.faa.gov>. Marking and lighting requirements will be established during their aeronautical studies.

H. Wind turbine obstruction marking and lighting shall be white paint on the structures and seven structures identified below will have additional synchronized flashing red lights as outlined in chapters 4, 12, and 13, of Advisory Circular AC 70/7460-1K. The advisory circular is available online at https://oeaaa.faa.gov/oeaaa/external/content/AC70_7460_1K.pdf. It is also free of charge, from the Department of Transportation, Subsequent Distribution Section, M-494.3, 400 7th Street, SW, Washington, DC 20590.

The following wind turbines shall have the synchronized, flashing red lights:

2004-AAL-107-OE, WT-4,
2004-AAL-111-OE, WT-8,
2004-AAL-115-OE, WT-14,
2004-AAL-118-OE, WT-15,
2004-AAL-122-OE, WT-19,
2004-AAL-128-OE, WT-25, and
2004-AAL-132-OE, WT-29.

S1-S2-S3 marking and lighting will be assigned during their aeronautical studies.

I. Within five days after the structure reaches its greatest height, proponent is required to file a FAA form 7460-2, Actual Construction notification, at the OE/AAA website (<http://oeaaa.faa.gov>). This Actual Construction notification, along with the wind turbine site surveys, will be the source documents detailing the site location, site elevation, structure height, and the date the structures were built for the National Aeronautical Charting Group (NACG) to map the structure on aeronautical charts and update the national obstruction database.

September 2, 2005 DPH Narrative

The Federal Aviation Administration (FAA) has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77 concerning the proposed Fire Island wind turbines. Details on each wind turbine structure are listed in a table within the attachment.

The initial findings of these studies indicated that the structures as described above would exceed obstruction standards and/or would have an adverse physical or electromagnetic interference effect upon navigable airspace

or air navigation facilities. Therefore, pending resolution of the issues described below, it is hereby determined that the structures are presumed to be a hazard to air navigation.

The studies revealed that the potential for electromagnetic interference exists. See the attachment for further information.

A copy of this determination will be forwarded to the Federal Communications Commission if the structures are subject to their licensing authority.

NOTE: Pending resolution of the issues described above, the structures are presumed to be a hazard to air navigation. This determination does not authorize construction of the structures even at a reduced height. Any resolution of the issues described above must be communicated to the FAA so that a favorable determination can be subsequently issued.

If more than 60 days from the date of this letter has elapsed without attempted resolution, it will be necessary for you to reactive the studies by filing a new FAA form 7460-1, Notice of Proposed Construction or Alteration.

If we can be of further assistance, please contact our office at (907) 271-5863. On any future correspondence concerning this matter, please refer to the Aeronautical Study Numbers listed above.

Signature Control No: 379718-402177

Robert van Haastert
Specialist, Obstacle Evaluation Service

DPH Attachment
Aeronautical Study Numbers 2004-AAL-104-OE through 2004-AAL-136-OE

* * * Determination of Presumed Hazard * * *

No. Aeronautical Study	NAD 83		Site		AGL feet	AMSL feet
	Latitude (N)	Longitude (W)	Elevation MSL			
1 2004-AAL-104-OE	61deg. 9' 32.51"	150deg. 13' 36"	249.3		413	662.3
2 2004-AAL-105-OE	61deg. 9' 26.01"	150deg. 13' 40"	229.7		413	642.7
3 2004-AAL-106-OE	61deg. 9' 20.51"	150deg. 13' 46"	246.1		413	659.1
4 2004-AAL-107-OE	61deg. 9' 08.02"	150deg. 13' 52"	213.3		413	626.3
5 2004-AAL-108-OE	61deg. 9' 00.02"	150deg. 13' 57"	259.2		413	672.2
6 2004-AAL-109-OE	61deg. 8' 54.02"	150deg. 13' 50"	246.1		413	659.1
7 2004-AAL-110-OE	61deg. 8' 49.02"	150deg. 14' 04"	196.9		413	609.9
8 2004-AAL-111-OE	61deg. 7' 49.52"	150deg. 14' 52"	242.8		413	655.8
9 2004-AAL-112-OE	61deg. 7' 45.02"	150deg. 15' 01"	196.9		413	609.9
10 2004-AAL-113-OE	61deg. 7' 42.02"	150deg. 15' 6.5"	213.3		413	626.3
11 2004-AAL-114-OE	61deg. 7' 38"	150deg. 15' 15"	213.3		413	626.3
12 2004-AAL-115-OE	61deg. 7' 34.5"	150deg. 15' 25"	164.0		413	577.0
13 2004-AAL-116-OE	61deg. 7' 31"	150deg. 15' 38"	98.4		413	511.4
14 2004-AAL-117-OE	61deg. 7' 29.5"	150deg. 15' 51"	49.2		413	462.2
15 2004-AAL-118-OE	61deg. 8' 36.01"	150deg. 11' 26"	196.9		413	609.9

16 2004-AAL-119-OE	61deg. 8' 31.51"	150deg. 11' 33"	196.9	413	609.9
17 2004-AAL-120-OE	61deg. 8' 28.01"	150deg. 11' 40"	232.9	413	645.9
18 2004-AAL-121-OE	61deg. 8' 23.01"	150deg. 11' 51"	229.7	413	642.7
19 2004-AAL-122-OE	61deg. 8' 19.01"	150deg. 12' 00"	164.0	413	577.0
20 2004-AAL-123-OE	61deg. 8' 15.01"	150deg. 12' 40"	147.6	413	560.6
21 2004-AAL-124-OE	61deg. 8' 11.01"	150deg. 12' 48"	164.0	413	577.0
22 2004-AAL-125-OE	61deg. 8' 07.01"	150deg. 12' 54"	147.6	413	560.6
23 2004-AAL-126-OE	61deg. 8' 03.51"	150deg. 13' 03"	131.2	413	544.2
24 2004-AAL-127-OE	61deg. 8' 01"	150deg. 13' 10"	114.8	413	527.8
25 2004-AAL-128-OE	61deg. 7' 58.5"	150deg. 13' 09"	164.0	413	577.0
26 2004-AAL-129-OE	61deg. 7' 53.01"	150deg. 13' 24"	147.6	413	560.6
27 2004-AAL-130-OE	61deg. 7' 52"	150deg. 13' 24"	229.7	413	642.7
28 2004-AAL-131-OE	61deg. 7' 47.02"	150deg. 13' 38"	246.1	413	659.1
29 2004-AAL-132-OE	61deg. 7' 43.52"	150deg. 13' 46"	229.7	413	642.7
30 2004-AAL-133-OE	61deg. 7' 40.02"	150deg. 13' 53"	246.1	413	659.1
31 2004-AAL-134-OE	61deg. 7' 37.02"	150deg. 13' 59"	278.9	413	691.9
32 2004-AAL-135-OE	61deg. 7' 33.02"	150deg. 14' 07"	262.5	413	675.5
33 2004-AAL-136-OE	61deg. 7' 30.02"	150deg. 14' 15"	246.1	413	659.1

The Chugach Electric Association's Fire Island Wind Turbine Project consists of 33 wind turbines incorporating the Vestas V90-3.0MW generator in a nacelle mounted on 262 foot steel poles, roughly 20 miles of transmission power lines, and an electrical substation to transfer wind generated power to the Anchorage area electric grid. Each wind turbine generator has a rated electrical output of 3,000 kilowatts and the wind turbine blades have a 90 meter (295 feet) diameter span. The wind turbine blades will rotate in an operational 9-19 revolutions per minute (rpm) range. Wind turbine blade speed at 19 rpm, at the outer tip, would be 200 miles per hour.

The proposed wind turbine locations are contained on Fire Island, within nine (9) nautical miles of the Airport Traffic Control Tower (ATCT) at Ted Stevens Anchorage International Airport (ANC). ANC is one of only two airports in Alaska with a Category III instrument landing system (ILS).

ANC Tower Operations

Year	Itinerant			Local			Total
	Air	Air	General	Military	Aviation	Military	
2002	121,384	85,743	89,227	5,637	7,17	55	309,225
2003	120,003	76,601	85,070	5,045	6,055	24	292,798
2004	127,595	84,458	84,525	5,934	6,946	2	309,460

The FAA evaluated the proposed wind turbine operational effects on four FAA facilities: the Anchorage Very High Frequency Omni-directional radio range (VOR)/Distance Measuring Equipment (DME), Airport Surveillance Radar (ASR)-8 and ASR-11, and the co-located Airport Traffic Control Tower (ATCT) and TRACON operations. This extensive evaluation took 17 months to complete.

The Anchorage VOR/DME, is located at N61deg. 09' 03" W150deg. 12' 23" (NAD 83) with a site elevation of 279 ft. MSL and antenna height of 296 ft. MSL. The proposed wind turbine locations varies from 4,000 to 13,700 feet in distance from the Anchorage VOR/DME which is located 5.2 nautical miles from the landing threshold of ANC Runway (RWY) 7R.

The Anchorage VOR/DME provides azimuth and course guidance to eight (8) VOR Federal Airways: V-319, V-320, V 334, V 438, V-440, V-441, V-456, & V-462 and eight (8) Jet Routes J-111, J-115, J-124, J-125, J-133, J-501, J 511, J 804R. The Anchorage VOR/DME is a component of six (6) standard instrument approach procedures (SIAP) into ANC: ANC ILS RWY 7L, ANC ILS RWY 7R, ANC ILS RWY 14, ANC ILS RWY 7R (CAT II), ANC ILS RWY 7R (CAT III), and ANC VOR RWY 7R; three (3) ANC departure procedures (DPs): Anchorage THREE, KNIK SIX, & TURNAGAIN TWO; and five (5) Standard Terminal Arrival (STAR) procedures: AMOTT FIVE, DENALI ONE, ELLAM TWO, TAGER THREE & YESKA TWO. Additionally, Take-off Minimums and (Obstacle) Departure Procedures require the use of Anchorage VOR/DME facility.

The VOR/DME siting criteria are contained in FAA Order 6820.10, VOR, VOR/DME, and VORTAC Siting Criteria, and reiterated in FAA Advisory Circular (AC) 150/5300-13, Airport Design. Specifically, FAA Order 6820.10, paragraph 17 (e) titled "Structures" states "All structures that are partly or entirely metallic shall subtend vertical angles of 1.2 degrees or less, measured from ground elevation at the antenna site." AC 150/5300-13, paragraph 604 (b) Clearances states "Terminal VOR signals are susceptible to distortion caused by reflections. Structures should be at least 1,000 feet (300 meters) from the antenna. Metal structures beyond 1,000 feet (300 meters) should not penetrate a 1.2 degree angle measured from the antenna base."

The FAA William J. Hughes Technical Center conducted a Math Modeling study using the Ohio University VPPM version 3.06 to model the turbine masts. Model results indicate a near-total loss of the Anchorage VOR service volume if the wind turbines are installed as planned. The primary reason for this is that most of the wind turbines exceed the elevation criteria of 1.2 degrees as stated in the FAA Order 6820.10. Also, the sheer number of turbines to be installed is a factor. The effects of the blades are harder to predict, because their effects are transient. Modeling suggests that there could be many multipath interferences caused by the blades, but the location of their effects is dependent on wind direction. Because of the relatively low speed of the blades, the cyclical bearing errors observed will be dependent on receiver filtering.

Wind Turbine Bearing & Distance to Anchorage VOR/DME

ID	Wind Turbine	True Bearing	Distance in feet	Angle Degrees from VOR base
1	2004-AAL-104	313.23	4,377.20	5.024
2	2004-AAL-105	304.63	4,114.51	5.071
3	2004-AAL-106	295.81	4,087.88	5.335
4	2004-AAL-107	277.32	4,007.59	4.971
5	2004-AAL-108	265.91	4,231.39	5.332
6	2004-AAL-109	258.22	4,462.08	4.886
7	2004-AAL-110	252.73	4,780.01	3.969
8	2004-AAL-111	222.87	10,178.16	2.121
9	2004-AAL-112	222.84	10,797.07	1.756
10	2004-AAL-113	222.89	11,220.82	1.773
11	2004-AAL-114	223.03	11,802.56	1.686
12	2004-AAL-115	223.57	12,397.99	1.377
13	2004-AAL-116	224.53	13,097.25	1.017
14	2004-AAL-117	225.99	13,657.77	0.769
15	2004-AAL-118	130.65	4,205.34	4.512
16	2004-AAL-119	138.31	4,280.67	4.433
17	2004-AAL-120	144.82	4,345.69	4.844
18	2004-AAL-121	154.19	4,509.87	4.625
19	2004-AAL-122	161.18	4,718.36	3.622

20 2004-AAL-123	184.90	4,890.31	3.302
21 2004-AAL-124	188.99	5,344.24	3.197
22 2004-AAL-125	191.24	5,795.92	2.785
23 2004-AAL-126	194.58	6,241.24	2.436
24 2004-AAL-127	196.67	6,676.15	2.136
25 2004-AAL-128	198.50	7,118.83	2.399
26 2004-AAL-129	200.11	7,567.93	2.133
27 2004-AAL-130	201.85	7,984.24	2.611
28 2004-AAL-131	203.10	8,387.74	2.597
29 2004-AAL-132	204.53	8,871.51	2.349
30 2004-AAL-133	205.41	9,328.45	2.335
31 2004-AAL-134	206.34	9,741.83	2.429
32 2004-AAL-135	207.30	10,281.56	2.210
32 2004-AAL-136	208.42	10,734.44	2.029

The proposed wind turbine locations are in areas where there are no VOR/DME performance restrictions, however, model results indicate a significant air navigation hazard via an electromagnetic effect would occur if the wind turbines were constructed. Likewise, any proposed location within the siting criteria would present an adverse effect and an air navigation hazard.

For a substantial adverse effect situation to be present, the situation must need both an adverse effect, i.e., electromagnetic interference to the operation of an air navigation facility, Anchorage VOR/DME, or the signal used by aircraft, and have a impact on a significant volume of aeronautical operations. The reported ANC Tower Operations indicate regular and continuing activity, which is considered a significant volume. Thus, the Chugach Electric Fire Island Wind Turbine Project will have a substantial adverse effect on air operation into Ted Stevens Anchorage International Airport.

It is important to note that any relocation of the Anchorage VOR/DME involves more than the physical movement. Each SIAP, DP, & STAR will have to have extensive Terminal Instrument Procedures (TERPS) design work, an aircraft flight check and validation of facility performance, and air traffic controller training. Revising air traffic routes below 3,000 feet ft. MSL will initiate National Environmental Policy Act (NEPA) requirements leading to an Environmental Assessment and/or an Environmental Impact Statement. Each VOR Federal Airway and Jet Route involved with a change will require TERPS design work, an aircraft flight check and validation, along with extensive rulemaking procedures detailed in Title 14 Code of Federal Regulation Part 71.

The Minimum Vectoring Altitude (MVA) in the vicinity of Fire Island is currently 1,600 feet ft. MSL. Eleven of the turbines will be higher than 649 feet ft. MSL (sites identified as 1, 3, 5, 6, 8, 14, 28, 30, 31, 32, & 33) which will raise the MVA to 1,700 feet within three miles of these turbines. This will add to the complexity of the facility MVA chart and create potential problems for air traffic controllers. The instrument approach procedure final approach fix will be at a lower altitude than the facility MVA, not a normal situation.

An existing departure procedure, Fire Island Route, allows pilots departing Campbell Lake to stay low-level and fly around the Anchorage Class C controlled airspace to the west and depart to points north. Pilots on the Fire Island Route may fly this procedure without the requirement to contact air traffic controllers nor have a transponder-equipped aircraft. The Anchorage Class C airspace was designed with this specific 600 foot exclusion area for operations to/from Campbell Lake. The 600-foot altitude limit for the route is an upper limit that provides pilots flying it at least 1,000 feet of vertical separation from any heavy jet aircraft that might be on final to ANC Runway 7R or 7L. Changing the minimum altitudes for this departure procedure with the

construction of the proposed wind turbines would place small aircraft in unsafe proximity to heavy jet aircraft wake turbulence.

Currently, the ASR-8 radar is used to separate and radar vector air traffic to the Anchorage area airports: ANC, Merrill Field, Lake Hood, Lake Hood Seaplane Base, & Elmendorf Air Force Base. It is located at N61deg 10' 43.47" W150deg 00' 50.85" (NAD 27) with an antenna height of 314 feet ft. MSL.

The ASR-8 is a two-dimensional, 60 nautical mile range, S-Band, radar using two klystron amplifiers. The ASR-8 is planned to be replaced by the Digital ASR-11, currently in test, optimization, & validation checks.

The ASR-11 is located at N61deg 09' 04.98" W150deg 12' 23" (NAD 27) with an antenna height of 375 ft. MSL. It is currently not used for air traffic control.

An FAA study was conducted with the following conclusions:

1. Wind turbines would likely cause primary clutter (false target presentation and permanent echos) on controller radar displays in their immediate vicinity. They would likely cause interference with primary radar returns from aircraft flying directly over them, especially small, general aviation type aircraft. This interference may cause short duration loss of target identification.
2. Wind turbines would cause beacon (transponder) false targets, when aircraft are lower than 1,000 feet ft. MSL and close to the turbines (<.23nm for the ASR-8/<.59 nm for ASR-11).
3. Wind turbines could cause both primary and beacon shadowing (dead zone/loss of targets) behind the turbines (1300 feet for ASR-8/1500 feet for ASR-11).
4. Beam distortion should not be a problem for either radar.

The study mentioned that some of the negative impacts may be mitigated via software modifications to the ASR-8 and ASR-11. However, the turbine blades will result in primary radar returns that cannot be subtracted by Moving Target Indicator (MTI) circuitry. Permanent radar display clutter in these areas is not acceptable.

The proposed wind turbine locations are within what is considered to be a critical operations area, an area extending from the runway out to a 10 mile final including five (5) miles either side of the final approach course. This 50 square mile area is where the last opportunity for approach sequencing and spacing for arriving aircraft to the final approach course occurs. The potential radar clutter interference in this area is a major concern to Air Traffic personnel as it directly impacts the efficiency and capacity at Anchorage Ted Stevens International Airport.

Primary radar is the chief means of separating aircraft, while secondary radar provides the ability of computer-assisted tracking. The possible loss of primary radar returns in these maneuvering areas would limit the controller's ability to provide merging target procedures for aircraft on approach relative to any aircraft that might be flying on the Fire Island route. The Anchorage Airport Traffic Control management is opposed to any degradation of their primary radar capabilities.

There are additional impacts in the radar controlled environment when secondary radar is used for separation of transponder-equipped aircraft in lieu of primary radar. Instead of separating from the centers of the radar targets as with primary radar, a controller must separate targets from the ends of the beacon slashes. This can lead to adding up to two miles of required separation between aircraft, thereby reducing the number of aircraft on final; resulting in lower arrival rates and potential delays.

The potential for an adverse effect to the capacity and efficiency of air traffic flow to/from Anchorage Ted Stevens International Airport exists.

-- last line --